

## CLAIMS

What is claimed is:

1. A method for monitoring condition of a material, said method comprising:  
5       representing the condition of the material with multiple states, at least one of the  
          states observable with an inspection;  
          using the multiple states with a model to estimate state progression; and  
          scheduling an inspection based on the progression of the multiple states.
- 10   2. A method as claimed in Claim 1 wherein the states comprise a damage state.
3. A method as claimed in Claim 1 wherein the states comprise a precursor state.
4. A method as claimed in Claim 1 wherein the model is used to pre-compute a  
15       database of damage progression conditions as a function of the states for rapid  
          assessment of damage condition for decision support.
5. A method as claimed in Claim 1 wherein the states are selected to ensure  
          observability of a particular damage progression behavior mode.
- 20   6. A method as claimed in Claim 1 wherein at least one of the multiple states is an  
          initially preassumed crack size.
7. A method as claimed in Claim 1 wherein the inspection is performed by a  
25       nondestructive evaluation method.
8. A method as claimed in Claim 1 wherein the inspection comprises onboard  
          diagnostics.

9. A method as claimed in Claim 1 wherein the inspection comprises eddy current sensors mounted on a surface of the material.
10. A method as claimed in Claim 1 wherein at least one of the states is fatigue.
- 5 11. A method as claimed in Claim 10 wherein fatigue damage progression is monitored continuously.
- 10 12. A method as claimed in Claim 10 wherein fatigue damage progression is monitored occasionally.
13. A method as claimed in Claim 12 further comprising:  
increasing frequency of inspection for fatigue damage progression monitoring as the damage progresses.
- 15 14. A method as claimed in Claim 1 wherein the model is adapted as the states progress.
15. A method as claimed in Claim 1 wherein the material is part of an aircraft component.
- 20 16. A method as claimed in Claim 15 further comprising:  
deciding disposition of a component based on the material condition states.
17. A method as claimed in Claim 16 wherein the disposition comprises aircraft maintenance.
- 25 18. A method as claimed in Claim 16 wherein the disposition comprises repair or rework.
- 30 19. A method as claimed in Claim 16 wherein the disposition comprises airworthiness.

20. A method as claimed in Claim 1 further comprising:  
monitoring rates of change of states.
- 5 21. A method as claimed in Claim 21 wherein the rates of change of selected states are  
determined from inspections at at least two different times.
22. A method as claimed in Claim 1 further comprising:  
selecting a health control action designed to achieve a quantitative goal  
10 according to a control algorithm.
23. A method as claimed in Claim 22 wherein the control action is rework.
24. A method as claimed in Claim 23 wherein the rework is shot peening.  
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25. A method as claimed in Claim 22 wherein the quantitative goal is a reduction of  
total ownership cost without reducing readiness.
26. A method as claimed in Claim 25 wherein the quantitative goal is constructed from  
20 an assessment of available quantitative current and historical information combined  
with expert qualitative information.
27. A method for health control of an article comprising:  
examining material condition of an article with an eddy current sensor;  
25 determining presence of an early stage damage;  
performing a health control action on the article; and  
establishing a baseline condition for future inspections with another examination  
of the article with the eddy current sensor.
- 30 28. A method as claimed in Claim 27 wherein the eddy current sensor is a sensor array.

29. A method as claimed in Claim 27 wherein the sensor is mounted to a surface of the article.

5 30. A method as claimed in Claim 27 wherein the sensor is scanned over a surface of the article.

31. A method as claimed in Claim 27 further comprising:  
integrating the health control action with scheduling of inspections.

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32. A method as claimed in Claim 27 wherein the control action is rework.

33. A method as claimed in Claim 32 wherein the rework is shot peening.